

COLOR IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a color image forming
5 apparatus, and more particularly to a color image forming
apparatus of the type in which images formed by a plurality of
image forming units are superimposed on an intermediate transfer
belt, and those superimposed images are collectively transferred
onto a recording sheet.

10 In a conventional color Xerography basis image forming
apparatus, a called tandem type image forming apparatus is
employed for the purpose of increasing printing speed. In this
type of the apparatus, image forming sections or units are
arranged side by side. Toner images are successively
15 superimposed to form a color image.

Each image forming unit is formed with a photo-receptor
unit for forming an electrostatic latent image and a developing
unit for supplying toner to the photo-receptor unit.

In this type of the image forming apparatus, the image
20 forming units are arranged side by side. Accordingly, the
apparatus is long in the direction in which the image forming
units are arranged. Further, in a case of where images are
superimposed one on another on a recording paper, the fixing
units are also arranged side by side. A length of the image
25 forming apparatus is further increased. Consequently, the

tandem type image forming apparatus needs an apparatus installing area.

A technique to solve the problem is disclosed in JP-A-11-15227, for example. The technique is directed to the
5 image forming apparatus of the vertically mounting, tandem type.

Fig. 8 is a view schematically showing a conventional image forming apparatus. The conventional image forming apparatus is composed of a plurality of photo-receptors 28a (Bk), 28b (C), 28c (M) and 28d (Y) vertically arranged, image forming means for
10 forming images of different colors on the photo-receptors 28a to 28d, a transport/transfer belt 37 for attracting a transfer sheet conveyed from a registration roller 12 which is disposed facing the photo-receptors 28a to 28d, and a fixing unit 13 for fixing a composite color image on a transfer sheet having been
15 transported by the transport/transfer belt 37. In the image forming apparatus of the type in which images are superimposed from the photo-receptors 28a to 28d onto a transfer sheet having been transported by the transport/transfer belt 37, a length of the transfer-sheet transporting path ranging from the
20 registration roller 12 to the first photo-receptor 28a (Bk) (= photoreceptor at which the transfer sheet first arrives) of those photo-receptors 28a to 28d is selected to be 1/2 or shorter than a length of the passable transfer sheet having the smallest size as viewed in the sheet passing direction.

25 Further, the publication discloses the image forming

apparatus in which a length of the transfer-sheet transporting path ranging from the registration roller 12 to the attracting means is selected to be $1/2$ or shorter than a length of the passable transfer sheet having the smallest size as viewed in the sheet passing direction.

Additionally, the publication discloses the image forming apparatus in which a length of the transfer-sheet transporting path ranging from the photo-receptor 28d (Y) (= photoreceptor at which the transfer sheet last arrives) of those photo-receptors 28a (Bk), 28b (C), 28c (M) and 28d (Y) to the fixing unit 13 is selected to be $1/2$ or shorter than a length of the passable transfer sheet having the smallest size as viewed in the sheet passing direction.

In the conventional image forming apparatus of the vertically mounting, tandem type, the transport/transfer belt 37 electrostatically attracts a transfer sheet from a sheet supply cassette 9 located in a lower part of the apparatus, transports the transfer sheet in a vertical direction, and successively superimposes color images formed by image forming units 38a (Bk), 38b (C), 38c (M) and 38d (Y) on the recording medium to thereby form a color image. Following this, the transfer sheet bearing the thus formed toner image thereon is separated from the transport/transfer belt 37, and transported to a fixing device, and the toner image is fixed on the transfer sheet. A height of the image forming apparatus manufactured by the

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conventional technique described above is relatively high, but
an area occupied by the apparatus when it is installed is reduced.

In the conventional technique, the toner images are
transferred onto a recording medium, such a sheet of paper, in
5 a superimposing manner. Accordingly, the thickness and a
moisture absorbing property of the sheet (transfer sheet) and
others affect the image transfer. This results in insufficient
stability of the image reproduction.

Where a thick recording sheet is passed through the
10 transporting path, a stiffness of the thick recording sheet is
strong. Accordingly, the sheet transporting force of the
registration roller or the fixing unit is larger than an
electrostatic attracting force of the transport/transfer belt.
As a result, the recording sheet tends to slip at the attracting
15 part, possibly causing the out-of-color-registration

In the event of jamming such as paper jamming during a
continuous printing operation, in particular in the event that
the recording medium is left at a portion where the images are
successively transferred on the recording medium, it is difficult
20 to remove the jammed sheet. In this case, the user handles the
sheet having much color toner not fixed yet sticking to there.
Accordingly, there is much chance that his/her hands and clothes
are frequently soiled, and further the color toner particles
fly into the air to contaminate air.

25 Further, in design, the space between the adjacent color

image forming units is reduced as much as possible in order to
reduce the apparatus height. Therefore, the component parts
are required to be reduced in size, thickness and diameter. This
results in insufficient rigidity of the image forming units per
5 se and the drive means. Where the insufficient rigidity is
present, it is difficult to secure the positioning accuracy of
the image forming units and the drive accuracy as major factors
in the image formation. Accordingly, the color image formed
is deteriorated in the out-of-color-registration and the color
10 irregularity of the color image.

Further, the image forming units per se are reduced in
size. Accordingly, a space used by the user for replacement
of the image forming units as expendables is narrow, and the
operability is deteriorated in the replacement work.

15 SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to
provide a color image forming apparatus which is reduced in size,
ensures the stable picture quality regardless of the thickness
and a moisture absorbing property of the sheet and others, makes
20 it easy for the user to remove a jammed sheet at the time of
paper jamming, and provides an easy work of replacing the image
forming units as expendables.

The present invention may be described in at least the
following conceptual descriptions: (1) A plurality of image
25 forming units are individually positioned to and held with an

intermediate transfer body unit; (2) A plurality of photo-receptors are fixedly supported by one housing to form an assembled developing unit, and the assembled developing unit is positioned to and held with the intermediate transfer body unit; and (3) One of plural photo-receptors is fixed to and supported by one housing to form a photo-receptor unit, and the remaining photo-receptors are fixed to and supported by one housing to form an assembled developing unit, and the photo-receptor unit and the assembled developing unit are individually positioned to and held with the intermediate transfer body unit. An intermediate transfer body unit and a plurality of image forming units are integrally assembled. With this feature, in attaching the image forming units to the apparatus main body, sufficient strength of the image forming units is secured while the size of the whole image forming apparatus is reduced. The stable picture quality is ensured regardless of the thickness and a moisture absorbing property of the sheet and others. Further, the user can remove a jammed sheet at the time of paper jamming.

Further, the image forming units have sizes suitable for expendables. A sufficient working space is secured. Operability in the replacing work of the image forming units is enhanced.

Further, the present invention may be described such that image forming units are vertically arranged from upstream to

downstream sides as viewed in a color forming process flow, while being successively shifted to optical units which are respectively arranged adjacent to the image forming units and at the same heights as of the image forming units. This feature
5 advantageously brings about reduction of an installation area and a height of a main body of the color image forming apparatus, and a size of the whole image forming apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view schematically showing a mechanical
10 arrangement of an image forming apparatus which is an embodiment of the present invention;

Fig. 2 is a view schematically showing a portion mainly containing an image forming part in the image forming apparatus;

Fig. 3 is a view schematically showing how to attach the
15 image forming units as expendables to and detaching them from the image forming apparatus;

Fig. 4 is a view schematically showing the attaching of the image forming units in the first embodiment;

Fig. 5 is a view schematically showing the attaching of
20 the image forming units according to a second embodiment of the invention;

Fig. 6 is a view schematically showing the attaching of an image forming units according to a third embodiment of the invention;

25 Fig. 7 is a view schematically showing the attaching of

an image forming units according to a fourth embodiment of the invention; and

Fig. 8 is a view schematically showing a conventional image forming apparatus.

5 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

<Embodiment 1>

In the description of the embodiments, sometimes, components each designated by a reference numeral followed by alphabetical letters are each generally indicated by the
10 reference numeral, for simplicity.

The preferred embodiments of the present invention will be described with reference to the accompanying drawings. Fig. 1 is a view schematically showing a mechanical arrangement of an image forming apparatus which is an embodiment of the present
15 invention. In Fig. 1, within a main body of the image forming apparatus, a transfer roller 36, an intermediate transfer body unit 18, and image forming units (photo-receptor units and developing units) 5a to 5d are arranged in this order as viewed in the counterclockwise direction on the paper of the drawing.
20 A fixing device 13 is disposed above the image forming units 5a to 5d. A sheet supply cassette 9 containing recording sheets 10 to be supplied to the apparatus is disposed under the fixing device.

A toner hopper 40 containing individual toners is disposed
25 above the optical units 1 (1a to 1d). Fig. 2 is a view

schematically showing a portion mainly including an image forming part in the image forming apparatus.

In Figs. 1 and 2, the optical units 1a to 1d, while corresponding to the respective colors, are disposed on the rear side (right side on the paper surface of the drawing) within the main body of the image forming apparatus. Those optical units emit laser lights 36a to 36d to photo-receptor 28a to 28d forming latent images in horizontal directions. The optical units 1 are each made up of a semiconductor laser (not shown), a polygon mirror 2, an image forming lens 3, and a reflecting mirror 4. The polygon mirror 2 receives light emitted from the semiconductor laser (not shown), and deflects it for scanning, and the laser light passes through the image forming lens 3 and the reflecting mirror 4 and lands on an exposure point on the photo-receptor 28.

Image forming units 5 (5a to 5d) used in the instant embodiment will be described with reference to Fig. 2. In each image forming unit 5, a photo-receptor unit 8 (8a to 8d) and a developing unit 6 (6a to 6d), which are provided for each color, may be considered to be assembled into one housing. In view of the recent trend of increase of the service life of expendables, it is convenient to sort those components based on the length of the service life and to assemble them into a housing. In this instance, one photo-receptor unit 8 (8a to 8d) and one developing unit 6 (6a to 6d) are housed in their own housings,

respectively.

The photo-receptor unit 8, as shown, includes a drum-like photo-receptor 28, a charging roll 29 for pre-charging the photo-receptor 28, and a roller cleaner 30, formed with an elastic sponge roll, for removing toner left on the photo-receptor 28. Those components are assembled into a cartridge. The photo-receptor 28 is designed to have a small diameter of 20mm with the intention of reducing a dimensional size of a space between the adjacent image forming units 5 (5a to 5d), and of securing a necessary transfer ability.

The roller cleaner 30 takes a shape of roll made of conductive urethane foam. Voltage opposite in polarity to the toner is applied to the roller cleaner 30, and in this state, the roller cleaner 30 is rotated in the same direction as of the photo-receptor 28, while in contact with the latter, to thereby scrape off the residual toner on the photo-receptor 28.

The developing unit 6 (6a to 6d) includes a developing case 27 (27a to 27d). The developing case 27 contains a developer containing its related color toner (not shown). A couple of agitators 26 (26a to 26d) as agitating members are located in the developing case 27. A developing roll 25 (25a to 25d) is provided at an opening part of the developing case 27, which is confronted with the photo-receptor 28. A developer thickness regulating blade (not shown) for regulating a thickness of the developer on the developing roll 25 is further provided.

Developing bias voltage (not shown) is applied to the developing roll 25. The developing roll thus biased causes the developer (toner) to fly to the photo-receptor 28. A gap between the photo-receptor 28 and the developing roll is adjusted by use of cap rollers which are located at both ends of the developing roll and coaxial with the latter.

Each developing unit 6 (6a to 6d) used in the instant embodiment may be installed as one unit in a guide part (not shown) of the apparatus main body. In the instant embodiment, however, to improve the maintenance for replacement, the developing units 6 (6a to 6d) are assembled into one housing such that if necessary, those are movable (The thus assembled developing units will be referred to as an assembled developing unit 24.). The assembled developing unit 24 is positioned and fixed in the guide part (not shown) in a state that if necessary, those are slidable toward the photo-receptor 28.

The intermediate transfer body unit 18 includes an intermediate transfer belt 19 which is stretched between two rollers (a lower belt drive roller 20 and an upper belt follower roller 21) and moved in a direction of an arrow A, a plurality of photo-receptors 28 (28a to 28d) arranged along a transport surface ranging from an upper part of the intermediate transfer belt 19 to a lower part thereof (from up to down in the paper surface of the drawing), and belt backup rollers 22 (22a to 22d) for primarily transferring toner images from the photo-receptors

28 onto the intermediate transfer belt 19, which the backup
rollers are located facing the photo-receptors 28 with respect
to the intermediate transfer belt 19. An intermediate transfer
belt cleaner 23 is disposed while being confronted with the upper
5 belt follower roller 21, which tensionally supports the
intermediate transfer belt 19.

In the instant embodiment, the rotation center shafts of
the photo-receptor units 8 (8a to 8d) are respectively guided
by and inserted into photo-receptor guide grooves 34 (34a to
10 34d) of unit side plates 33 that are provided on both sides of
the intermediate transfer body unit 18, and positioned in and
held with the photo-receptor guide grooves 34. With this
structural feature, the photo-receptor units 8 (8a to 8d) and
the intermediate transfer body unit 18 may be handled as if those
15 are integrally assembled into one cartridge.

Fig. 3 is a view schematically showing how to attach the
image forming units as expendables to and detaching them from
the image forming apparatus. Fig. 4 is a view schematically
showing the attaching of the image forming units in the first
20 embodiment.

As shown in Fig. 3, a door 17 is attached to the left side
of the apparatus main body. When the door 17 is opened, a
component attaching opening is formed in the apparatus main body.
The assembled developing unit 24 and the integral cartridge of
25 the photo-receptor units 8 (8a to 8d) and the intermediate

transfer body unit 18 are is inserted into and taken out of the apparatus main body.

A transfer roller 36 is mounted on the door 17. When the door 17 is closed, the transfer roller 36 collectively transfers
5 the toner images from the intermediate transfer belt 19 onto a recording sheet at a position where it is confronted with the upper belt follower roller 21 which tensionally supports the intermediate transfer belt 19.

In the instant embodiment, as shown in Fig. 1, the sheet
10 supply cassette 9 includes a feed roll 11 for feeding recording sheets 10 at predetermined timings. A registration roller 12 as nip transporting means is provided at position near an input of a sheet transporting path which is located between the feed roll 11 and a secondary transfer part. A sheet sensor (not shown)
15 of the optical type is located downstream of the registration roller.

In the instant embodiment, the sheet sensor detects the leading edge of the recording sheet 10. A timing of detecting the sheet leading end by the sensor is used for controlling,
20 for example, writing timings of electrostatic latent images in the optical units 1 (1a to 1d) in the image forming units 5 (5a to 5d).

A fixing device 13 as nip transfer means is provided on a sheet transporting path, which is located downstream of the
25 secondary transfer part. The fixing device 13 includes a heating

roll 15 and a pressing roll 16.

A sheet-discharging roll 14 is located downstream of the fixing device 13. Recording sheets emanating from the sheet-discharging roll are discharged into a sheet receiving
5 tray provided in an upper part of the housing.

Operation of the color image forming apparatus thus constructed will be described with reference to Figs. 1 and 2. Referring to Fig. 2, in the color image forming apparatus of the instant embodiment, the charging rolls 29 uniformly charge
10 the surfaces of the photo-receptors 28. The optical units 1 optically an image into the photo-receptors 28 by laser light 41 to thereby form latent images on the photo-receptors 28. Thereafter, the developer layer regulating blade (not shown) operates to provide thin toner layers on the developing rolls
15 25. The toner layers are each charged to have one polarity (plus or minus). In the developing section where the photo-receptors 28 are confronted with the developing rolls 25, the latent images are developed into toner images on the photo-receptors 28.

The toner images thus formed on the photo-receptors 28
20 are primarily transferred onto the intermediate transfer belt 19 with application of a given voltage to the belt backup rollers 22. In this case, the toner image formed by the most upstream image forming unit 5a (= image forming unit located in the most upper stage) is first primary-transferred onto the intermediate
25 transfer belt, and then the toner image formed by the image forming

unit 5b, is primary-transferred onto the belt and soon. Finally, plural toner images are transferred as a composite color toner image onto the intermediate transfer belt 19.

The recording sheet 10 fed from the sheet supply cassette
5 9 is transported along the sheet transporting path which is located on the opposite side of the image forming units 5 with respect to the intermediate transfer belt 19. The recording sheet 10 thus transported is inserted into the secondary transfer part which is confronted with the upper belt follower roller
10 21 of those two rollers (the lower belt drive roller 20 and the upper belt follower roller 21) which tensionally supports the intermediate transfer belt 19.

The toner images on the intermediate transfer belt 19 are secondarily transferred onto the recording sheet 10 in the
15 secondary transport part. The toner (not shown) that is left on the intermediate transfer belt 19 after the secondary transferring operation is removed by the intermediate transfer belt cleaner 23. Subsequently, the composite color toner image is fixed onto the recording sheet 10 by the fixing device 13
20 to thereby form a color toner image on the recording sheet. In a normal state or image forming state, the transfer roller 36 is in press contact with the intermediate transfer belt 19, and in a jam removal state, it is separated from the same.

As described above, in the embodiment mentioned above,
25 the photo-receptor units are individually positioned to and held

by the intermediate transfer body unit. With this unique feature, the photo-receptor units 8 (8a to 8d) and the intermediate transfer body unit 18 are handled as if those are integrally assembled into one cartridge. This structural feature accrues to many advantages. In attaching the image forming units to the apparatus main body, sufficient strength of the image forming units is secured while the size of the whole image forming apparatus is reduced. The stable picture quality is ensured regardless of the thickness and a moisture absorbing property of the sheet and others. Further, the user can remove a jammed sheet at the time of paper jamming. The image forming units have sizes suitable for expendables. A sufficient working space is secured. Operability in the replacing work of the image forming units is enhanced.

<Embodiment 2>

Fig. 5 is a view schematically showing the attaching of the image forming units according to a second embodiment of the invention. No or simple description will be given about the portions in the second embodiment which are the same as and similar to those in the first embodiment. In Fig. 5, plural photo-receptors 28 (28a to 28d) are assembled into one housing (not shown) to form an assembled developing unit 7. The photo-receptor units 8 (8a to 8d) are inserted into photo-receptor guide grooves 35 (35a and 35b) of unit side plates 33 that are provided on both sides of the intermediate transfer

body unit 18 such that the rotation center shafts of the photo-receptors 28a and 28d, which are respectively located most upstream and most downstream as viewed in the image forming process flow, are guided by and inserted into those photo-receptor guide grooves 35. And, the assembled developing unit 7 is positioned to and held with the intermediate transfer body unit 18 by means of unit fixing means 37. Thus, in the instant embodiment, the plural photo-receptor units 8 (8a to 8d) are assembled into one assembled developing unit 7. Therefore, those photo-receptor units 8 (8a to 8d) can be replaced with new ones at one time. This feature reduces a frequency of expendable replacements.

<Embodiment 3>

Fig. 6 is a view schematically showing the attaching of the image forming units according to a third embodiment of the invention. No or simple description will be given about the portions in the third embodiment which are the same as and similar to those in the first embodiment.

In the embodiment of Fig. 6, one of plural photo-receptors is fixed to and supported by one housing to form a photo-receptor unit 42. The remaining photo-receptors are fixed to and supported by one housing to form an assembled developing unit 43. Of those photo-receptor units, the assembled developing unit 43 is inserted into photo-receptor guide grooves 45 (45a and 45b) of unit side plates 33 that are provided on both sides

of the intermediate transfer body unit 18 such that the rotation center shafts of the photo-receptors 28a and 28c, which are respectively located most upstream and downstream as viewed in the image forming process flow are guided by and inserted into those photo-receptor guide grooves 45. And, the assembled developing unit 43 is positioned to and held with the intermediate transfer body unit 18 by a unit fixing means 37. The photo-receptor unit 42 is inserted into photo-receptor guide grooves 44 of the unit side plates 33 that are provided on both sides of the intermediate transfer body unit 18 such that the rotation center shaft of the photo-receptor 28d is guided by and inserted into those photo-receptor guide grooves 44. And, the photo-receptor unit 42 is positioned to and held with the intermediate transfer body unit 18.

As described above, in the instant embodiment, the photo-receptors are divided into two photo-receptor units, the photo-receptor unit 42 and the assembled developing unit 43. The reason for this follows. The color image forming apparatus is generally operated in two print modes, a monochromatic print mode and a color print mode. The frequencies of using those print modes are almost equal. Accordingly, if the photo-receptors are divided into the photo-receptor unit 42 for black printing and the assembled developing unit 43 for color (Y, M, C) printing, the photo-receptor unit may be replaced with a new one according to the frequency of using the photo-receptor

or photo-receptors. Therefore, the work of replacing the image forming units as expendables is enhanced, and further the running cost of the apparatus is reduced. Operation of the instant embodiment is omitted since the operations of the second and
5 third embodiments are correspondingly applied to the instant embodiment.

While some specific embodiments of the present invention has been described, the invention is not limited to such embodiments, but may be variously modified, altered and changed
10 within the true spirits of the invention. Further, it is readily understood that the number, positions, shapes and others of component parts are not limited to those described in the embodiments, but those may be altered and changed within design modification.

15 <Forth Embodiment>

Reference is made to Fig. 7. Each photo-receptor unit 8 (8a to 8d) used in the instant embodiment may be installed as one unit in a guide part (not shown) of the apparatus main body. In the instant embodiment, however, to improve the
20 maintenance for replacement, the photo-receptor units 8 (8a to 8d) are supportingly fixed to one housing by means of screws in a state that the rotation center axes of the photo-receptors are aligned with one another (The thus assembled developing units will be referred to as an assembled developing unit 7.). When
25 the assembled developing unit 7 is installed into the apparatus

main body, the photo-receptor units are vertically and obliquely arranged from upstream to downstream sides as viewed in a color forming process flow, while being successively shifted to optical units 1 (1a to 1d) disposed on the rear side of the apparatus
5 (on the right side on a paper surface of the drawing).

Fig. 7 is a view showing an image forming apparatus according to the fourth embodiment of the invention. A housing of the main body is constructed as shown in Fig. 7, a door 17 is attached to the left side of the apparatus main body. When
10 the door 17 is opened, a component attaching opening is formed in the apparatus main body. The assembled developing unit 24, the assembled developing unit 7 and the intermediate transfer body unit 18 are inserted into and taken out of the apparatus main body. A transfer roller 36 is mounted on the door 17. When
15 the door 17 is closed, the transfer roller 36 collectively transfers the toner images from the intermediate transfer belt 19 onto a recording sheet at a position where it is confronted with the upper belt follower roller 21 which tensionally supports the intermediate transfer belt 19.

20 In the instant embodiment, as shown in Fig. 1, the sheet supply cassette 9 includes a feed roll 11 for feeding recording sheets 10 at predetermined timings. A registration roller 12 as nip transporting means is provided at position near an input of a sheet transporting path which is located between the feed
25 roll 11 and a secondary transfer part. A sheet sensor (not shown)

of the optical type is located downstream of the registration roller. In the instant embodiment, the sheet sensor detects the leading edge of the recording sheet 10. A timing of detecting the sheet leading end by the sensor is used for controlling, for example, writing timings of electrostatic latent images in the optical units 1 (1a to 1d) in the image forming units 5 (5a to 5d).

A fixing device 13 as nip transfer means is provided on a sheet transporting path, which is located downstream of the secondary transfer part. The fixing device 13 includes a heating roll 15 and a pressing roll 16.

A sheet-discharging roll 14 is located downstream of the fixing device 13. Recording sheets emanating from the sheet-discharging roll are discharged into a sheet receiving tray provided in an upper part of the housing.

As described above, the intermediate transfer belt 19 is obliquely disposed which is transportingly rotated in a state that the intermediate transfer belt 19 is tensionally supported by at least two rollers (the lower drive roller and the upper follower roller). The plurality of photo-receptors 28 are arranged along a surface of the intermediate transfer belt 19 which is transportingly moved from upper to lower sides (from upper to lower in a paper surface of the drawing). Toner images are successively transferred onto the intermediate transfer belt 19 to form a toner image of different colors. The toner image

is transferred onto a recording sheet by using the transfer unit including the upper follower roller 21 which tensionally supports the intermediate transfer belt, and the transfer roller 36. Thereafter, the color image is fixed by use of the fixing unit
5 13.

As described above, in the instant embodiment, the plurality of image forming units are obliquely disposed while being successively shifted to the optical units. This feature advantageously brings about reduction of an installation area
10 and a height of a main body of the color image forming apparatus, and a size of the whole image forming apparatus.

As apparent from the first embodiment shown in Fig. 4, the photo-receptor units and the intermediate transfer body unit may be handled as if those are integrally assembled into one
15 cartridge. This cartridge may be detachably mounted to the image forming apparatus.

In the instant embodiment, as shown in Fig. 1, the intermediate transfer belt is obliquely disposed which is transportingly rotated in a state that the intermediate transfer
20 belt is tensionally supported by at least two rollers, the lower drive roller and the upper follower roller. The plurality of photo-receptors are arranged along a surface of the intermediate transfer belt which is transportingly moved from upper to lower sides. The toner image is transferred onto a recording sheet
25 by using the transfer unit including the upper follower roller

which tensionally supports the intermediate transfer belt, and the transfer roller. Further, in the color image forming apparatus, a fixing unit is disposed above the image forming units, and a sheet transport path, shaped like U, is disposed on the opposite side of the photo-receptors with respect to the intermediate transfer belt, and recording sheets are supplied upward from a sheet supply unit located in a lower-most part. With this feature, excessive rise of temperature within the apparatus when the fixing unit is heated is suppressed. A color picture is stably formed. An operator can attach and detach the intermediate transfer body unit and the image forming units to and from the apparatus main body, and can remove a jammed sheet, while being confronted with the sheet transporting surface. While some specific embodiments of the present invention has been described, the invention is not limited to such embodiments, but may be variously modified, altered and changed within the true spirits of the invention. Further, it is readily understood that the number, positions, shapes and others of component parts are not limited to those described in the embodiments, but those may be altered and changed within design modification. Throughout the drawings, like or equivalent portions are designated by like reference numerals.

The present invention which is constructed as described above has the following advantages. Since the plurality of image forming units are individually positioned to and held with the

intermediate transfer body unit, the photo-receptor units and the intermediate transfer body unit may be handled as if those are integrally assembled into one cartridge. This structural feature accrues to many advantages. Sufficient strength of the image forming units is secured while the size of the whole image forming apparatus is reduced. The stable picture quality is ensured regardless of the thickness and a moisture absorbing property of the sheet and others. Further, the user can remove a jammed sheet at the time of paper jamming.

10 The image forming units have proper sizes when those are handled as expendables. A sufficient working space is secured. Operability in the replacing work of the image forming units is enhanced.

15 In an embodiment of the invention, a plurality of photo-receptors are fixedly supported by one housing to form an assembled developing unit, and the assembled developing unit is positioned to and held with the intermediate transfer body unit. Since the plurality of image forming units are assembled into one assembled developing unit, the plural photo-receptors can be replaced with new ones at one time, and a frequency of replacing expendables with new ones is reduced.

25 In another embodiment of the invention, one of plural photo-receptors is fixed to and supported by one housing to form a photo-receptor unit, and the remaining photo-receptors are fixed to and supported by one housing to form an assembled

developing unit. The photo-receptor unit and the assembled
developing unit are individually positioned to and held with
the intermediate transfer body unit. With this feature, the
photo-receptor unit may be replaced with a new one according
5 to the frequency of using the two print modes, the monochromatic
print mode and the color print mode. Therefore, the work of
replacing the image forming units as expendables is enhanced,
and further the running cost of the apparatus is reduced.

The present invention which is constructed as described
10 above has the following advantages. In the instant embodiment,
the plurality of image forming units are obliquely disposed while
being successively shifted to the optical units. This feature
advantageously brings about reduction of an installation area
and a height of a main body of the color image forming apparatus,
15 and a size of the whole image forming apparatus.

Further, the recording sheet is transported along the sheet
transporting path located on the opposite side of the
photo-receptors with respect to the intermediate transfer belt.
This feature makes it easy for the user to remove a jammed sheet
20 at the time of paper jamming. An operator can attach and detach
the intermediate transfer body unit and the image forming units
to and from the apparatus main body, and can remove a jammed
sheet, while being confronted with the sheet transporting
surface.

25 Further, the fixing unit is disposed above the image

forming units. Excessive rise of temperature within the apparatus when the fixing unit is heated is suppressed. A color picture is stably formed.

Furthermore, the intermediate transfer belt cleaner is
5 disposed facing the upper follower roller which tensionally supports the intermediate transfer belt, at a position closer to the image forming units. Accordingly, the intermediate transfer belt cleaner may be stably pressed on the intermediate transfer belt. This feature stabilizes the cleaning
10 performance. Additionally, it enables waste toner (not shown) discharged from the intermediate transfer belt cleaner to outside and waste toner (not shown) discharged from the image forming units to drop into one waste toner (not shown) box (not shown).

CROSS REFERENCE TO RELATED APPLICATION

15 This application is based upon and claims the benefit of priority of Japanese Patent Application No. 2002-310748 filed on October 25, **2002**, and Japanese Patent Application No. 2002-325180 filed on November 8, **2002**, the contents of which are incorporated herein by reference in its entirety.